SPECIAL ISSUE: Loss of system pressure

Technical Assistance for Public Water Systems

The Idaho Drinking Water Newsletter

Department of Environmental Quality Idaho Drinking Water Program

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Causes and prevention

Loss of pressure in drinking water systems

Even for well-designed water systems, a sudden loss of pressure* (also known as depressurization) is a serious threat to public health. If a loss of pressure occurs, the flow of water could be reversed from the customer's home back into the distribution lines exposing the entire public water system to contamination.

When water pressure drops in a system, there is a reverse flow of water that can create problems by moving the water in the wrong direction. This reversal is known as "backflow" *(see "Backflow" page 3)*. If a cross-connections *(see "Cross-connection" page 3)* exists within a customer's plumbing system when a backflow occurs, then it is possible to contaminate the public's water supply.

So, what causes a loss of pressure?

Pressure loss can occur for any number of reasons, but listed below are some of the major causes.

- ❑ **A power failure** *(especially hazardous for systems without elevated water storage),*
- ❑ **Water main** *(or service line) installation, repair, or replacement,*
- ❑ **A broken water main or an unknown leakage**,
- ❑ **Inadequate water production**, *and*
- ❑ **High water usage**, *such as fire fighting or irrigating lawns and gardens where the amount of water being used exceeds the amount of water being supplied.*

What to do when there is a sudden drop in pressure

Following a loss of pressure, the system owner should take the following actions:

- ❑ **Immediately notify the public** *(at least within 24 hours)* **to drink bottled water** until further notice. ***(Note:** Boiling water for at least **one minute** will provide protection from pathogens, but boiling will not provide protection from chemical contaminants, such as nitrates, pesticides, fertilizers)*;
- ❑ **Notify the local regional office** of the Department of Environmental Quality (DEQ) or the local district health department of a potential problem;
- ❑ Next, the **owner must disinfect the system** *(smaller systems and mobile home parks may want to disinfect as they restore the pressure)*;
- ❑ **Flush the system** and test the water *(must obtain "total coliform absent" test results)*; and
- ❑ **Notify the public when the water is safe.**

Be prepared for unforseeable drops in pressure

For reasons of public health and liability, the owner or operator should take every reasonable precaution to limit the frequency and severity of a loss of pressure. *Here are some basic suggestions:*

1. Follow state requirements. According to the Idaho Rules for Public Drinking Water Systems, all public water systems must meet minimum pressure standards:

"Any public water system shall be capable of providing sufficient water during maximum hourly demand conditions (excluding fire flow) to maintain a minimum pressure of 20 psi (per square inch) within the system measured at the consumer's water tap."

"Any public water system constructed after July 1, 1985, shall maintain a minimum design working pressure of 35 psi and a normal working pressure of 60 psi, measured at the consumer's water tap."

"In-line booster pumps shall maintain an operating pressure no less than 20 psi, and shall be supplied with an *automatic cutoff** when intake pressure is less than or equal to 5 psi."

"Booster pumps located on suction lines directly connected to any storage reservoirs shall be supplied with an *automatic cutoff** when pressure is equal to or less than 2.5 psi." **(**Note:** An automatic cutoff serves two purposes: 1) To prevent the emptying or loss of water in the line or reservoir, and 2) it protects the pump from burning up when there is no water in the pump.)*

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** For purposes of this article, "loss of pressure" refers to either a complete loss of water pressure or to situations where a system's distribution pressure falls below the minimum of 20 pounds per square inch (psi).*

Loss of pressure *Continued from page 1*

You can review the drinking water rules on the internet at http://www.state.id.us/adm/adminrules/rules/idapa58/58index.htm. Once you are at the site, drop down to the entry "58.01.08, Public Drinking Water Systems" to open the rules.

2. Know how to disinfect a water main. Any water system or part of a water system that looses pressure should be completely disinfected and tested for bacteria before serving the public. The requirements are found in the standard AWWA manual, Disinfecting Water Mains. To obtain a copy, contact AWWA, 6666 West Quincy Ave., Denver, CO 80235, Tel: 303.794.7711 or order on-line at www.awwa.org/bookstore/ <http://www.awwa.org/bookstore/> . The cost is $20.00 for AWWA members and $30.00 for non-members.

The essential concepts of the AWWA standard are listed below:

a. Flush debris from the system, repressurize using highly chlorinated water, and hold for a lengthy period (50 ppm for 3 hours, or 25 ppm for 24 hours).

b. Flush the system until all the chlorine is gone and then take a bacteria sample.

c. Only after a "total coliform absent" sample is obtained, can the operator tell the public that water from the public water system is again safe to drink.

3. Consider the use of standby generators. Having a standby generator is a way to maintain pressure in your system if loss of power occurs periodically or to deal with future power shortages. A generator will allow the system to generate its own power to run a pump on a well or a booster pump.

4. Inform the public.

- ❑ All customers should receive advance public notification on how to protect themselves during a sudden loss of pressure.
- ❑ A sample notification form should be in your water system's operation and maintenance manual.
- ❑ The water system operator should repeat the notice for each individual loss of pressure case.

In summary, DEQ recognizes that there are varying degrees of public health significance for each loss of pressure case. Also, practical responses may differ depending on such factors as 1) the length of depressurized pipe, 2) the amount of dirt or groundwater that got into the main, 3) the structure of the system or how it is designed, 4) the intensity of local disinfection of the repaired section, 5) distance to an acceptable flushing valve, and 6) the length of time the line was depressurized.

Consequently, if in doubt, err on the side of public health protection, i.e., use more rigorous disinfection procedures, and always provide immediate customer notification. ■

"Where backflow occurs and cross-connections are present, you have all of the necessary elements for contamination of a home plumbing system and possibly, contamination of the entire local public water system."

Required elements of a public notice

1. A description of the violation or situation;
2. When the violation or situation occurred;
3. Potential adverse health effects, using language in EPA's Public Notification Handbook, or language for monitoring violations;
4. Population(s) at risk;
5. Whether alternative water supplies should be used;
6. Actions consumers should take including when they should seek medical help, if known;
7. What you are doing to correct the violation or situation;
8. When you expect to return to compliance;
9. Name, business address, and phone number for additional information; and
10. Standard language encouraging distribution to all persons served, where applicable.

Backflow

Backflow is the reversal of water flow from its normal direction - the normal direction being from the source to the tap. This reverse flow can send a customer's contaminated water back into the public system's safe drinking water supply.

Backflow is normally caused by either ***backpressure*** or ***backsiphonage***. Backflow will occur through any unprotected cross-connection whenever backpressure and backsiphonage conditions exist.

Backpressure occurs when the pressure within a plumbing system is greater than the pressure of the incoming water supply. This "within-the-system" pressure pushes contaminated water "back" toward the safe drinking water supply.

Causes: Backpressure can be caused by the installation of pumps that increase pressures above the pressure of the water system supply, thereby forcing undrinkable water in the opposite direction of normal flow and back into the safe water supply line.

Steam boilers can also cause backpressure (or other equipment that heats water causing thermal expansion and resulting in pressures in excess of the incoming water pressure).

Elevated piping or tanks can also cause backpressure.

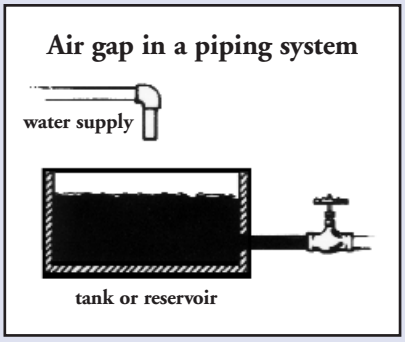
Backsiphonage is a backflow caused by a negative pressure (i.e., a vacuum or partial vacuum). This vacuum effect is similar to drinking water through a straw - water and possibly substances from a contaminated source are pulled back or sucked up into a potable (drinkable) water supply.

Causes: Backsiphonage (or a vacuum) can occur when there is a stoppage of water supply due to, for example, nearby fire fighting or a break in a water main. Simply flushing the water pipes to clean them may cause this phenomenon.

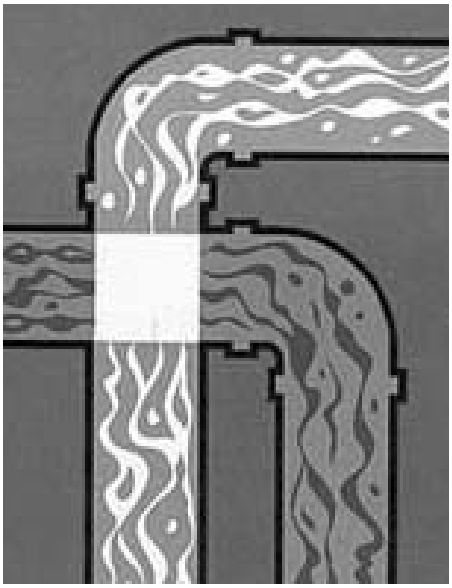
When this condition occurs, if you have an unprotected cross-connection (like an immersed hose filling a bucket of concentrated herbicide, or a garden hose submerged in a horse watering tank), the matter at the end of the hose will be sucked back into the public drinking water system, starting at the customer's house. ■

Preventing backflow

A backflow preventer is a means or mechanism to prevent backflow. The best and simplest means of preventing backflow is the air gap, which provides a physical separation between the end of a water supply outlet and the flood-level rim of a receiving vessel.



If an air gap is not possible, the next best mechanism for preventing backflow is a mechanical backflow preventer, which provides a physical barrier to backflow. Such devices or "assemblies" stop water from coming back into the safe drinking water supply system through spring loaded check valves thus preventing backpressure or backsiphonage. Of course, only use approved assemblies.



What is a cross-connection?

A "cross-connection" is any actual or potential connection between the public water supply and a source of contamination or pollution.

A cross-connection link can occur through a direct pipe-to-pipe connection of a contaminated water source to a drinkable water source, which are linked without proper control valves.

In many cases, however, cross-connections result indirectly from a backflow when the pressure in a customer's plumbing system becomes greater than the pressure in the public water supply. If this common cross-connection is unprotected, the backflow forces contaminated water back into the safe drinking water supply.

Cross-connections constitute a serious public health hazard. For water systems, the cross-connection problem is an ongoing one because piping systems are continually being installed, altered, or extended. For the system operator, this means constant vigilance. ***Remember that the Idaho Rules for Public Drinking Water Systems require that "all suppliers of water for community water systems" must implement a cross-connection control program.***

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Examples of common cross-connections in homes and commercial properties:

- ❑ submerged hoses
- ❑ lawn sprinkler systems
- ❑ fire protection system
- ❑ toilet tank
- ❑ tank with submerged inlet
- ❑ solar heating system
- ❑ boiler
- ❑ cooling tower
- ❑ swimming pool
- ❑ fountain
- ❑ auxiliary water sources

The ordinary garden hose is probably the most common cross-connection offender. It can easily be connected to potable (drinkable) water supplies and used for a variety of potentially dangerous applications, including mixing, diluting, and spraying pesticides and fertilizers.

Have you ever turned the water on to wash your car and then dropped the end of the hose into a bucket with soap? The moment the end of the hose becomes submerged in the soapy water you have created a cross-connection. The good quality water exiting the hose is in direct contact with the non-drinkable soapsuds. If pressure was lost in the distribution system while you were filling the bucket, the entire contents of the bucket could be siphoned back into your house and eventually into the water main.

Preventing cross-connections

Backflow preventers can reduce the risk and protect the home and the public water system from widespread illness and disease. These devices prevent water from moving backward into the water system through combinations of check valves or hydraulic breaks.

Backflow preventers come in many sizes, specifications and degrees of complexity, depending on the problem being addressed. Contact your local DEQ regional office for specific questions or for a list of approved backflow prevention devices. Most devices need to be tested annually by a certified tester.

Probably the most significant safeguard against contamination from cross-connections is maintaining system pressure. The danger of contamination increases dramatically as system pressure drops below 20 psi.

This reverse flow occurs when the pressure in a customer's plumbing system becomes greater than the pressure in the public water system. ■

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